model 250-H

ac power source

OPERATIONS AND SERVICE MANUAL

CERTIFICATION

Pacific Electronics certifies that this instrument was thoroughly tested and inspected and found to meet or excel its published specifications when it was shipped from the facility.

WARRANTY

Pacific Electronics warrants each unit to be free from defects in material and workmanship. For the period of one year after purchase, Pacific Electronics will repair or replace any unit returned to our plant in Rosemead, California, by the original buyer, with shipping both ways prepaid by the buyer. Pacific Electronics is not responsible for consequential damage arising from the use of its equipment.

FIRST EDITION

MODEL 250-H

AC POWER SOURCE

OPERATIONS AND SERVICE MANUAL

PACIFIC PART NO. 106650

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WARNING

THIS UNIT CONTAINS VOLTAGES WHICH ARE POTENTIALLY LETHAL. IN ADDITION TO THE NORMAL HIGH VOLTAGE COMPONENTS, SOME OF THE EXPOSED HARDWARE OPERATES AT DANGEROUS POTENTIALS. THEREFORE, A CAUTIOUS APPROACH AND A GOOD UNDERSTANDING OF THE EQUIPMENT ARE ESSENTIAL PREREQUISITES TO OPERATING AND SERVICING THIS EQUIPMENT!

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SECTION 1
GENERAL DESCRIPTION

1.1 GENERAL DESCRIPTION

The Model 250-H is a solid-state linear power amplifier designed to serve as a rugged AC Power Source to 250 VA at the popular power frequencies. It is designed to operate from line power of 110 or 220 VRMS, 50-60 Hz.

The standard unit is equipped with a fixed internal oscillator pre-set to the desired frequency over the range of 47-500 Hz. Amplitude is continuously variable, 0-125 VRMS, and may be locked at a selected value.

The 250-H is fully protected against accidental shorts or overload, and against excessive internal temperature. It is designed for economy and reliability in fixed requirement applications.

1.2 PERFORMANCE SPECIFICATIONS

LINE VOLTAGE (normal)	105-125VRMS., 50-60 Hz. or 210-250VRMS. in series primary connection
LINE VOLTAGE (low line)	When connected for Low Line, will operate from 95-115 or 190-230VRMS, 50-60 Hz.
POWER FREQUENCY RANGE	47-500 Hz. Min.
INTERNAL OSCILLATOR RANGE	47-500 Hz., pre-set to the desired frequency
FREQUENCY ACCURACY	0.5%
FREQUENCY STABILITY[1] (fixed frequency option)	0.02% - 10 hours 0.1% - 30 days
AMPLITUDE STABILITY[1]	0.5% - 10 hrs @115VRMS 1.0% - 30 days @115VRMS
OUTPUT VOLTAGE	0-125 VRMS min. range
OUTPUT CURRENT	0-2 Amps. See derating curve
POWER FACTOR	0.7 Inductive or Capacitive
LOAD REGULATION	0.5% for 0-2 Amp load
LINE REGULATION	0.25% for 10% line change
DISTORTION	0.75% Thd.
SMALL SIGNAL BANDWIDTH	10K Hz. Approximate
OUTPUT REFERENCE	Floating, either output terminal may be grounded to chassis.
DC OFFSET	10MVDC Maximum
OVERLOAD PROTECTION	Electronic, automatic recovery
EFFICIENCY	50% Approximate

SPECIFICATIONS CONTINUED

AMBIENT TEMPERATURE	0 to 45°C Operating -25 to +85°C storage
DIMENSIONS	12"W x 13"D x 5¼"H
WEIGHT	22 lbs. non-isolated 40 lbs. isolated option
COOLING	Forced air, intake fan on front panel; exhaust fan on rear panel
MOUNTING	19" rack mount standard

NOTE:

1. All stability applications apply after a forty-eight hour burn-in.

SECTION 2
OPERATING INSTRUCTIONS

2.1 GENERAL CHARACTERISTICS

The 250-H is a general purpose source of AC Power applicable to linear loads at any power factor (see derating curve for operation at extremely low power factors). It can also be used to supply non-linear or rectified loads to a peak current of 4 amps. Peak loads above 4 amps may cause current limiting.

Output power is available at a terminal strip on the rear panel. With the isolation option, the machine output is fully isolated, and either output terminal may be grounded (tied to chassis). In the standard non-isolated version, machine output is common to line common.

CAUTION: The line power cord is equipped with a three terminal plug. The third, or ground, terminal ties chassis to house ground. It is hazardous to operate this equipment without the chassis referenced to house ground.

Each 250-H has been pre-set to a selected frequency in the 47-500 Hz range and labeled on the front panel. Should it be necessary to change the frequency setting, first consult the oscillator calibration section of this manual.

TURN ON: The unit may be turned on either with the line power switch or by plugging the power cord into the wall with the line power switch on. The machine may be turned on into a load which draws a heavy surge current for a short duration of time.

2.2 DERATING

The 250-H is designed to operate at any power factor and at any output voltage between 0 and 125VRMS. The principal limitation on machine output is thermal stress on the output power modules. Since internal dissipation increases with deviation from unity power factor, and with reduced output voltage, the user should keep operating conditions within the limits shown on Fig. 2: MODEL 250-H DERATING CURVES.

Operation beyond these limits will cause the output waveform to become limited.

2.3 SURGE LOADS

The 250-H is designed for instantaneous current limiting for self-protection. This limit is approximately 4 amps peak during full voltage sinewave peaks. However, the limit reduces to approximately 2 amps when the output voltage is held to near zero volts, as would be the case with an external short or heavy surge load. As the surge load becomes charged (e.g. rectifier-capacitor type load) the output voltage increases, as does the machine's ability to supply higher peak currents.

If the user wishes to turn on without current limiting action, he may do so in one of two ways:

1. He can turn ON with the Line Power Switch. This causes machine output to build up slowly - in about one second - permitting gradual buildup of output current.
2. He can turn AMPLITUDE control to zero. Turn on Line Power switch. Then gradually increase AMPLITUDE until full output is reached.

2.4 INPUT LINE

The standard 250-H is non-isolated and operates off of 110 Volt, 50-60 Hz line. With the isolation option, the line power transformer is wound with dual primaries connected in parallel for 110 Volt operation, series for 220 Volt operation.

Conversion to 220 Volt operation is accomplished at the transformer terminals as follows:

1. Remove jumper between terminals 4 and 2
2. Remove jumper between terminals 3 and 1.
3. Add jumper between terminals 3 and 2

Conversion from 220 to 110 Volt operation is accomplishe as follows:

1. Remove jumper between terminals 3 and 2
2. Add jumper between terminals 4 and 2
3. Add jumper between terminals 3 and 1

LOW LINE VOLTAGE conditions may occur in certain locations. The transformer is equipped with tapped secondary to supply extra voltage - about 10% - in this eventuality. Connections are as follows:

Normal Line (105-125VRMS)	Use secondary terminals 6 and 10 (Standard Connection)
Low Line (95-115VRMS)	Use secondary terminals 5 and 11

DO NOT OPERATE THE UNIT WITH MORE THAN 115 VOLTS INPUT WHEN USING SECONDARIES 5 and 11.

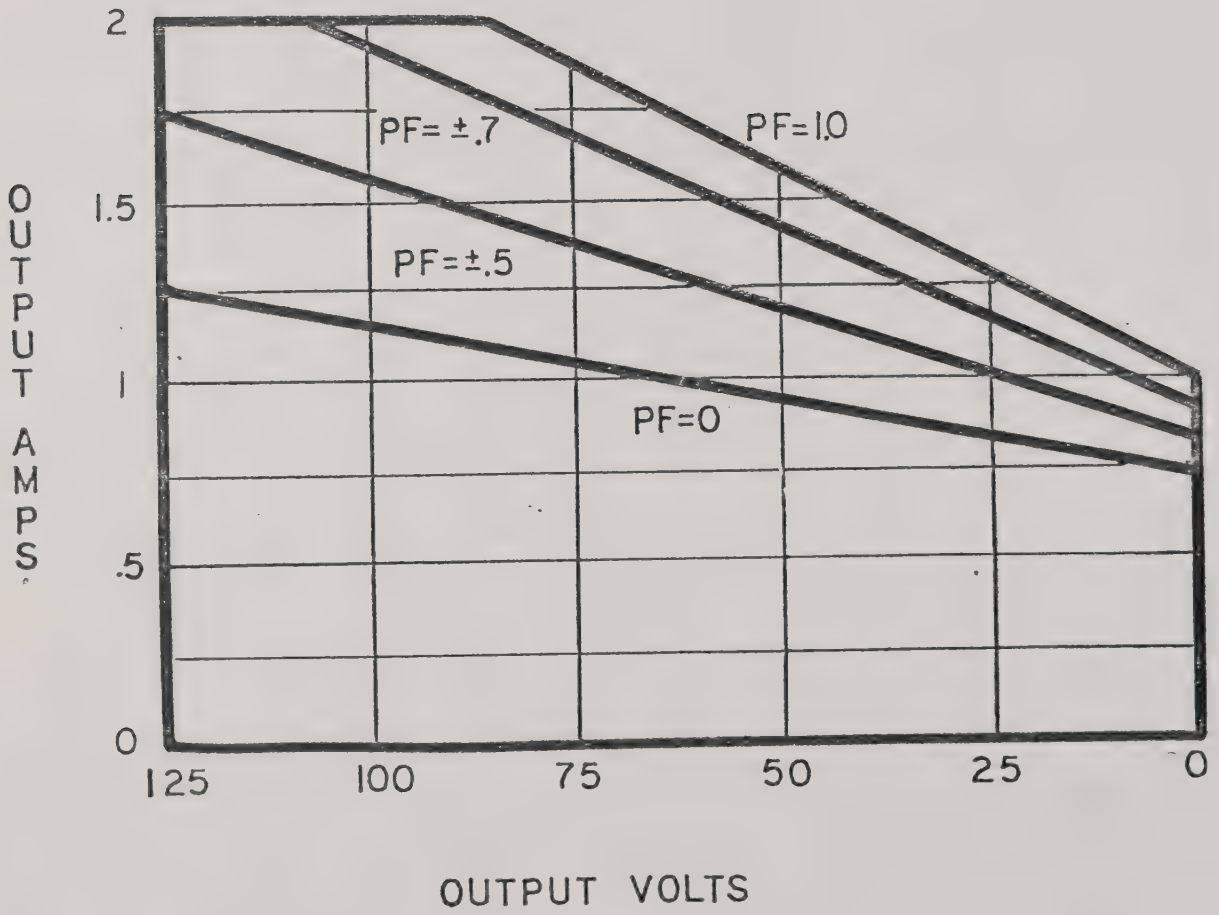


FIGURE 2 - MODEL 250 H DERATING CURVE

SECTION 3
PERIODIC MAINTENANCE AND CALIBRATION

3.1 REQUIREMENTS

The 250-H is designed for long periods of continuous unattended operation. The unit is conservatively rated and requires only infrequent service.

Pacific Electronic recommends Performance Verification per paragraph 3.2 of this manual at six-month intervals. If the unit has undergone major repairs, or if the unit fails Performance Verification, the unit should be recalibrated to paragraph 3.3.

3.2 PERFORMANCE VERIFICATION

1. Remove top cover. Carefully clean dust accumulation to ensure adequate cooling.
2. Turn unit on. Set AMPLITUDE control to zero. Measure DC voltage from output terminal to GND. DC offset is typically less than 5MV. If DC offset exceeds 10MV, the Power Amplifier should be serviced.
3. Observe output waveform with CRO. This should be a pure sinewave. Vary output control over its full range and make sure there is no clipping at the peaks of the sinewave. If clipping occurs, reduce oscillator amplitude adjustment R111.
4. Set output to 125VRMS. Check load regulation and verify that it is normal.

3.3 CALIBRATION PROCEDURE

During calibration it will be necessary to operate the 250-H with the cover removed. This exposes the technician to lethal voltages; extreme caution must be exercised.

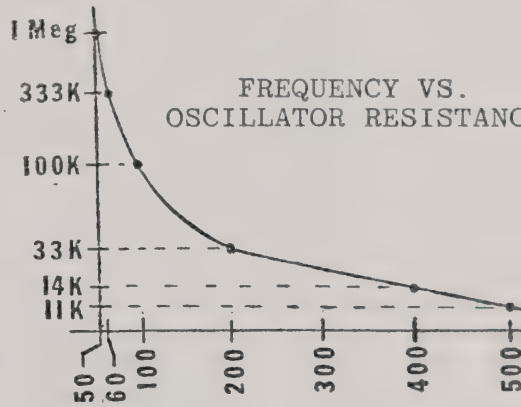
CAUTION

The 250-H has low impedance-high energy circuits. In addition to the shock hazard, there is considerable danger from explosive phenomena, i.e. explosion of electrolytic capacitors if installed incorrectly, accidental shorts with hand tools, etc. Safety glasses are recommended when servicing or calibrating this machine.

BEWARE OF POWER AMPLIFIER HEAT SINKS, WHICH ARE ELECTRICALLY HOT

3.3.1 OSCILLATOR

a) The oscillator circuitry is located on the Master Power Amp Assembly and has been pre-set to a selected frequency with trimming resistors 118 and 119. They may be varied to adjust the frequency but must always be kept equal. Consult the chart at right for approximate values.



b) Set oscillator amplitude with R111 so that oscillator output sinewave just barely fails to clip. Reduce R111 below the point where clipping just barely fails to occur.

c) If DC Offset is greater than ±10MVDC, replace amplifier A1.

3.3.2 CURRENT LIMIT

Turn AMPLITUDE to zero. Apply a 1 OHM 25 Watt resistor to output. Carefully increase AMPLITUDE while observing output with CRO. Current should start limiting at about ±2 amps peak, and should limit squarely as the AMPLITUDE is increased. Finally, when AMPLITUDE is set for a no load 125VRMS output, a short (1 OHM) on the output should cause current of about 2.75 amp (5.5 amps p-p). The limit on this parameter is 2.75 ± .25 amps. Adjust R63 for positive limit and R64 for negative limit as necessary to meet these limits. CAUTION: Do not adjust current above 3 Amps or damage may result to the unit.

Recheck after machine warms up. Make sure foldback current does not drift to a value higher than 1.25 amps.

3.3.3 DC OFFSET

A DC Offset of less than 10MVDC is normally insured by gain of amplifier A1. If A1 checks good but an offset greater than 10MVDC still appears on either amplifier, it may be necessary to change C3 on the amplifier.

SECTION 4
THEORY OF OPERATION

4.1 SYSTEM DESCRIPTION

The 250-H system and major wiring connections are illustrated in Fig.3. The 250-H consists of a main frame assembly and a master power amplifier assembly.

The main frame houses the transformer and filter portion of a conventional transformer-rectifier supply with capacitor input filter. Panel controls and other chassis mounted components are as illustrated in Fig. 3.

Signal originates with the oscillator and is routed to the Power Amplifier. The Power Amplifier amplifies the signal level to line voltage at the desired frequency at a power level of 250VA. In the non-isolated version, the output is referenced to AC Line common, whereas in the isolated machine, either terminal may be grounded.

4.2 MASTER POWER AMPLIFIER MODULE

4.2.1 This module contains the high purity oscillator and power amplifier. With a DC input of approximately ±200VDC, this module will generate the requisite output power at the desired frequency.

4.2.2 The power supply consists of a bridge rectifier BR1 and capacitive input filter C1-C2. Note that the +200VDC outputs are fused; removing the fuses will disable all outputs. Zener diodes VR1-4 form +15VDC power supplies for the oscillator and low voltage portions of the power amplifiers.

4.2.3 The sinewave oscillator is of a wien-bridge configuration and is formed by operational amplifier A2 and associated circuitry. Resistors R112 and R113 pre-set the frequency to approximately 45 Hz. Trimming resistors R118 and R119 are selected for the desired frequency. (Note: They must be of the same value.) After selecting the desired frequency, resistor R111 may have to be adjusted until no clipping is observed on A2 output.

Amplifier A3 is a buffer amplifier to drive the power amplifier.

The oscillator output has a slow-rise characteristic for turning on into surge-type loads. This feature is accomplished by capacitor C103-C104 which limits the rate of low voltage power supply rise.

4.2.4 The power amplifier section is a wide-band, low distortion linear amplifier capable of 250 VA continuous output at 125VRMS. It is electronically self-protected against overloads and overheating conditions.

Amplifier A1 and transistors Q1-Q8 form the voltage amplifier portion of the amplifier and translate the signal from 5 VRMS to the 125 VRMS level. Amplifier A1 has DC gain and insures the output of the amplifier to be 5 MVDC or less.

The power output section is a complimentary pair consisting of a triple darlington in the positive drive direction and a quasi-PNP darlington for the negative drive. To safely operate off of the line voltages, the output transistors are "totem-poled" to reduce voltage stress. The transistors are operated in series-parallel and the voltage across each device should be roughly equal.

The current limiting function is performed by Q3 for positive and Q14 for the negative. Potentiometer R63 sets the value of positive current limiting into a short, and R64 sets the negative limit. Foldback resistors R20 and R37 allow increased output current into reactive loads to insure safe operation of the unit.

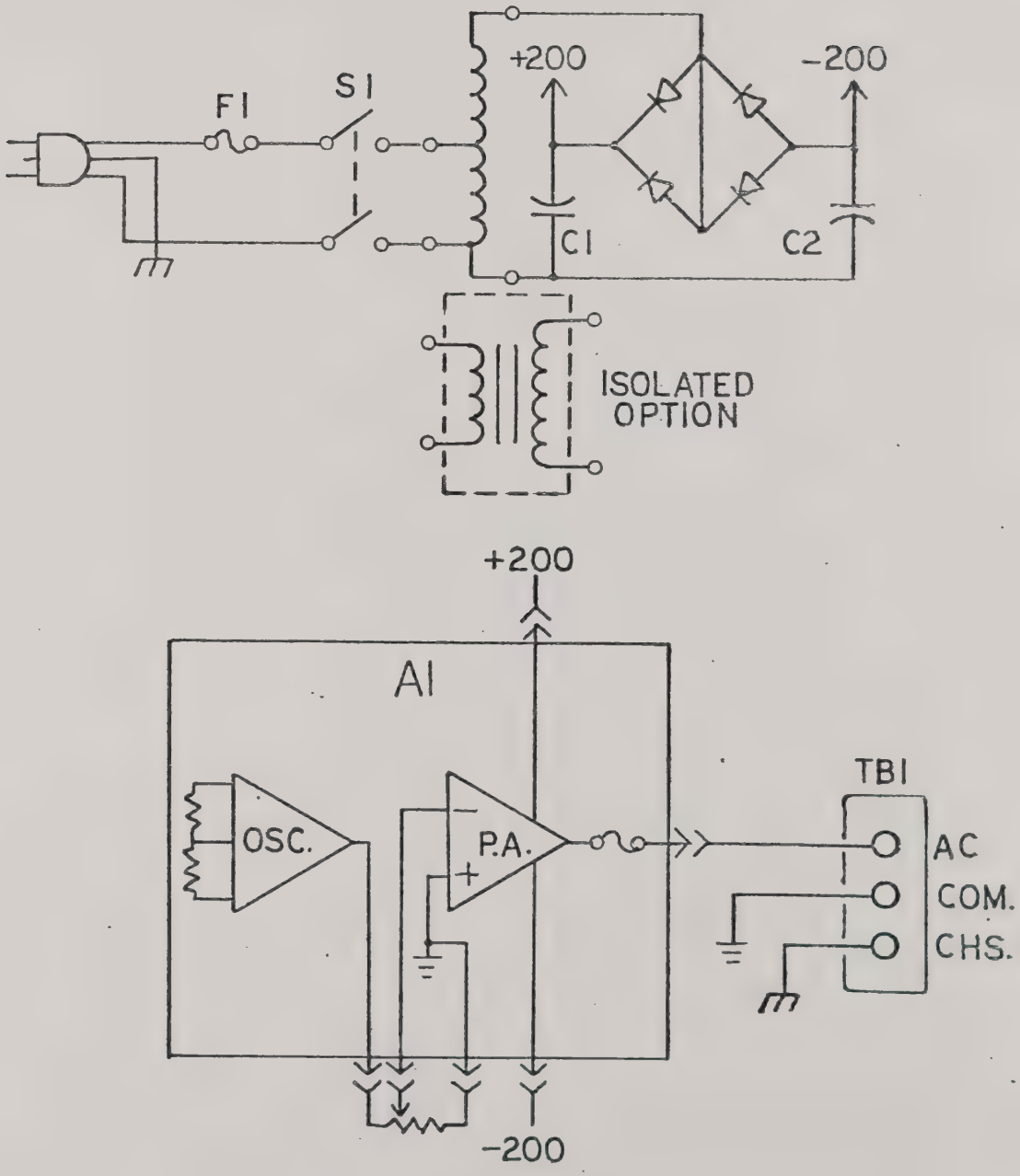


FIGURE 3. MODEL 250 H SYSTEM BLOCK DIAGRAM

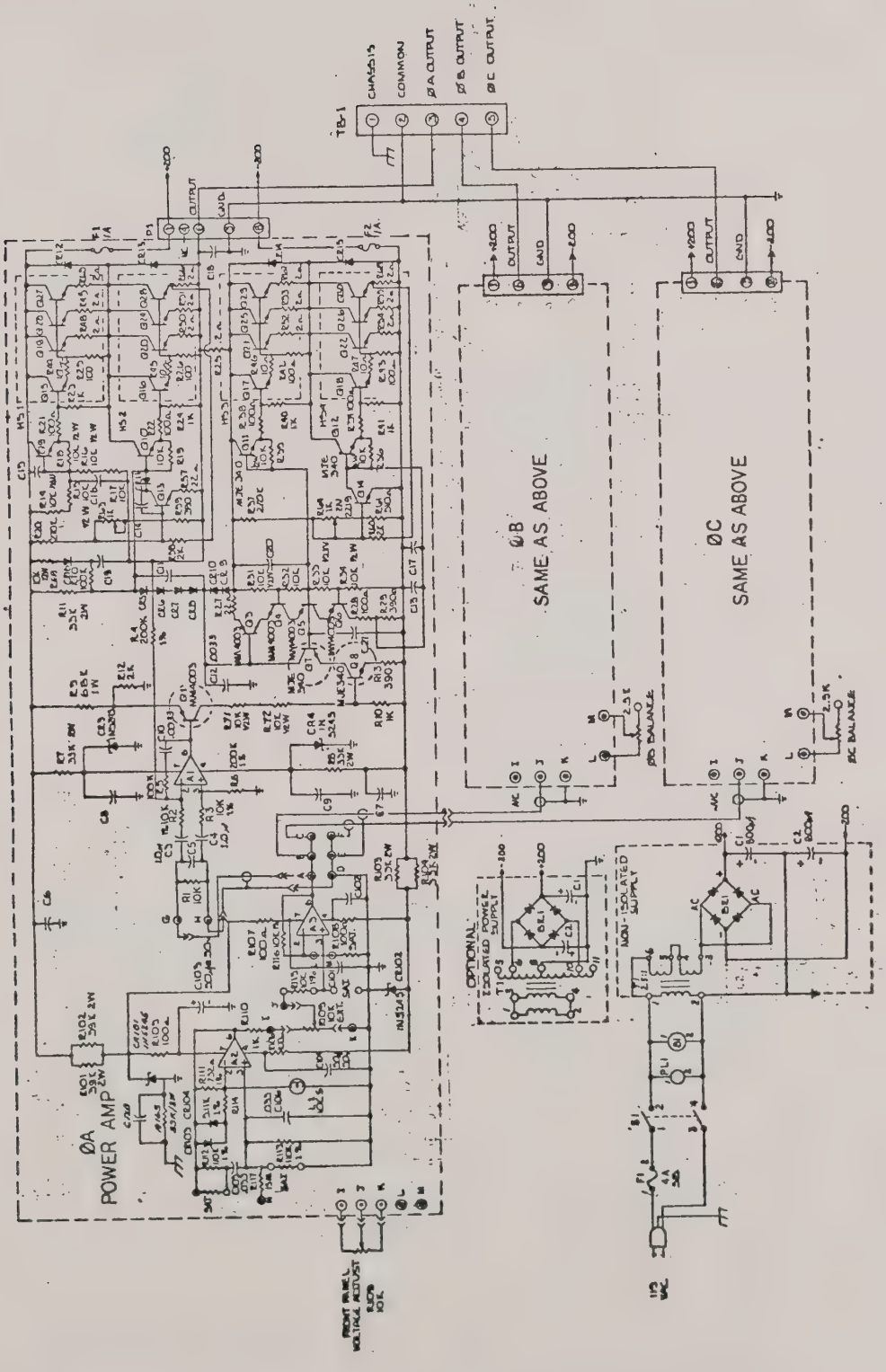


FIGURE 4. MODEL 250H/205H/305H SYSTEM SCHEMATIC

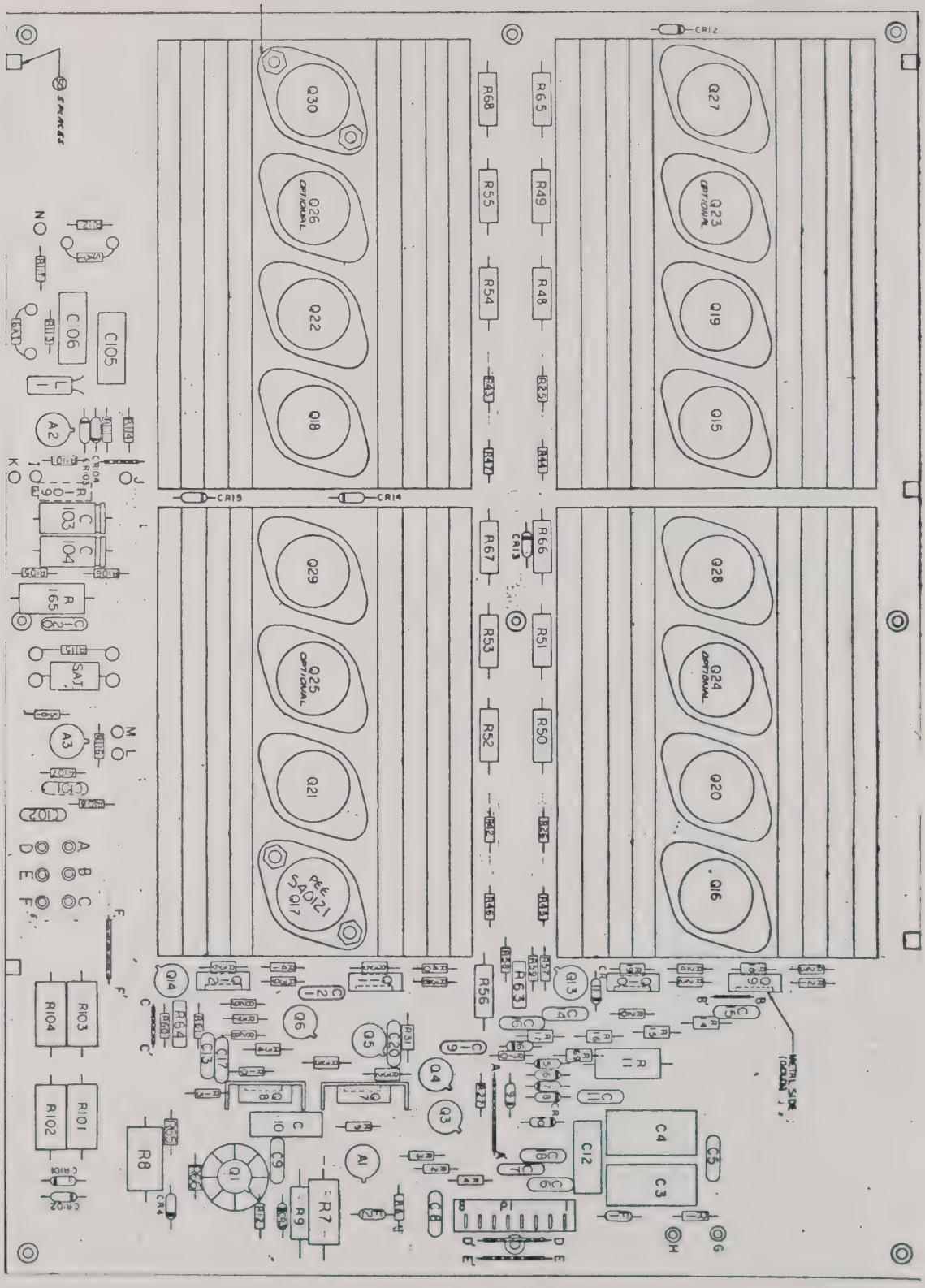


FIGURE 5. MASTER POWER AMPLIFIER COMPONENT PLACEMENT

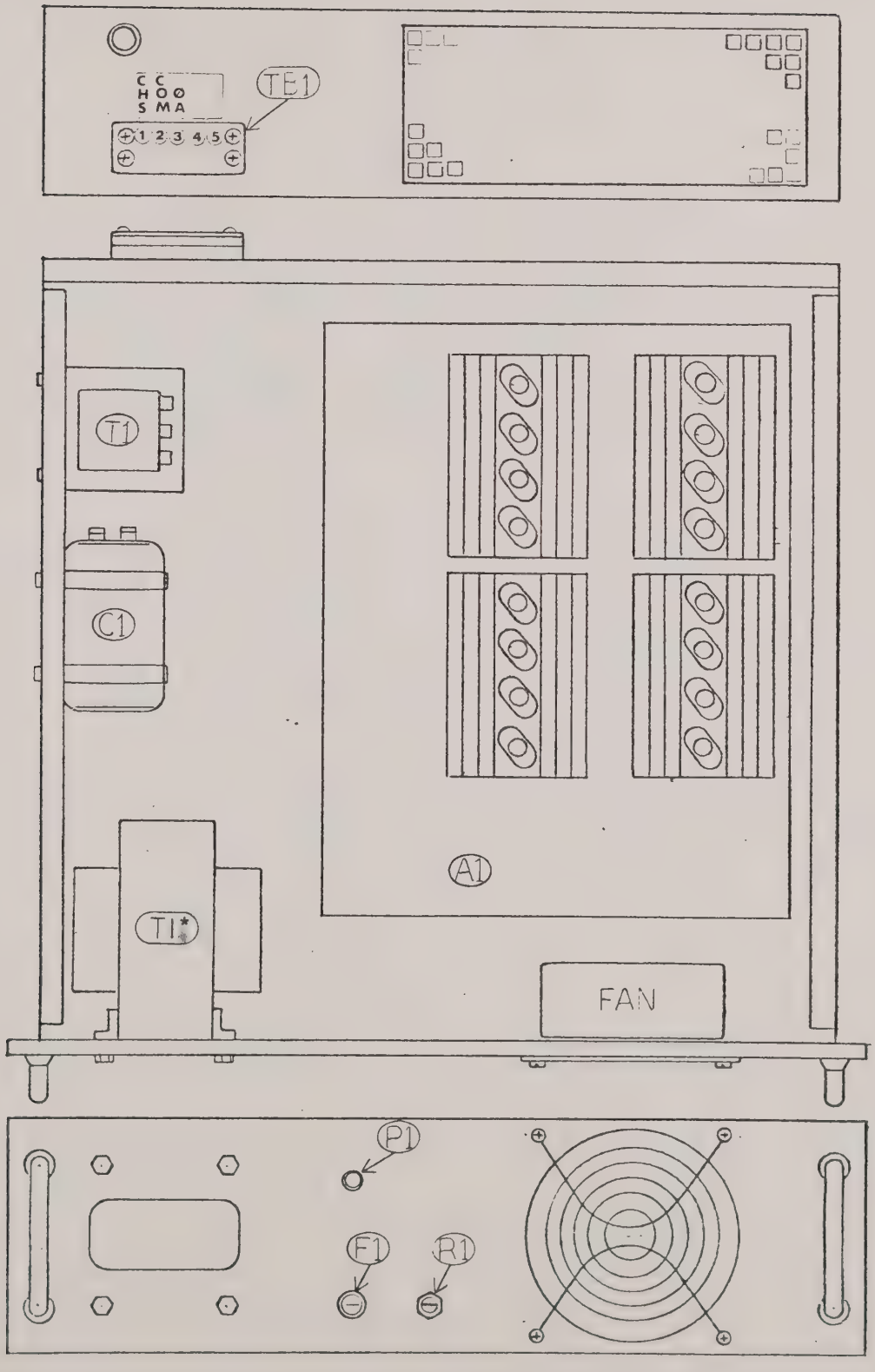


FIGURE 6. MODEL 250H ASSEMBLY DRAWING

SECTION 5

SERVICE

5.1 PRE-SERVICE INSTRUCTIONS

Before servicing, check to determine if equipment is within warranty period (one year), in which case the unit should be returned to the factory. Field repairs during this period may void the warranty

Complete assemblies may be ordered, as well as any components from Pacific Electronic. Always include unit serial number when ordering.

5.2 SERVICE AIDS

All normal adjustments may be made by either removing the top cover or removing the bottom cover screws and swinging up the chassis on its service loop for more accessibility.

For more detailed repairs requiring changing of components, it will be necessary to remove the master power amplifier board from the bottom cover to access it.

CAUTION: NOTE THAT THE HEATSINKS ARE ELECTRICALLY HOT AND PRESENT A HEALTH HAZARD. USE EXTREME CAUTION WHEN SERVICING THIS UNIT.

SECTION 5.3
REPLACEMENT PARTS

5.3 ORDERING INFORMATION

The AC Power Source Model 250-H has been designed to permit complete field servicing and repair. Each part or sub-assembly can be ordered from the vendor(s) listed in the following pages. The listing excludes vendor information for those parts which can be completely specified by their part number designation or component value. These parts may be purchased from any manufacturer or supplier who carries them under that designation.

Certain special parts must be ordered from Pacific Electronic. This applies to all items for which Pacific Electronic is the only listed vendor. When ordering replacement parts from Pacific Electronic, the order must be accompanied by the unit model and serial number.

250-A CHASSIS ASSEMBLY

Ref. Desig.	Description	Part Number	Vendor
BR1	Bridge, Rectifier	SCBA6	Semtech
C1, C2	Capacitor, Filter	86F211M	GE
F1	Fuse (4A Slo-Blo)	313004	Littlefuse
R109	Pot, Gain 10K	JAIL0405103VA RV41AYSA-103A	A-B
T1	Transformer, Power	100-45	KGS
T1	Transformer, Power	531052	PEE
TB-1	Terminal Block	602-Y-5	Kulka
	Front Panel	104001	PEE
	Side Panel	106601	PEE
	Rear Panel	104002	PEE
	Top Cover	104004	PEE
	Bottom Cover	106603	PEE
	Bar Mounting	104006	PEE
	Connector 8 Pin Female	90-50-7081	Molex
	Terminal Cover	104013	PEE
	Rear Panel Label	106605	PEE
	Power Amp Board	106660	PEE
	Fan	4450	Howard
	Fan Guard	6-182-033	Howard
	Handle, round	2050	H.H. Smith
	Ferrule	2055	H.H. Smith
	Cartridge, Datalamp	CR03-RCS-NIIT	Eldema-Cute
	Clip, Speed	515-0051	Dialight
	Connector	515-0012	Dialight
	Fuseholder, Panel	342028L	Littlefuse
	Switch, Line Power	7565K54C27	Cutler-Hammer
	Relief, Strain	R6-A	Rich Co.
	Cord, Power	17419	Belden
	Fastener, Utype Speed	C11228-632	Tinnerman

250-A CHASSIS ASSEMBLY

Ref. Desig.	Description	Part Number	Vendor
	Block, Capacitor Mounting	TMEH-S10-QO	Panduit
	Strap, Capacitor Mounting	PRT53H-QPO	Panduit
	Transformer Mounting Bracket	104008	PEE

250-H POWER AMPLIFIER BOARD

Ref. Desig.	Description	Part Number	Vendor
A1,2,3	OP Amplifier	LM741C	
C3,4	Capacitor 1uf @50v	75F7R5-105	G.E. Blackhawk
C5-9	Capacitor, Disc .05uf @500v	5GA-S50	Sprague
C10,12	Capacitor, Disc .0033 @500v	225P33294X03	Sprague
C11,13-21 C101,102	Capacitor, Disc .05uf @500v	5GA-S50	Sprague
C103,104	Capacitor, Disc 50uf @25v	TE1209	Sprague
C105,106	Capacitor, Disc .033 @400v	715P333-54KD3	Sprague
CR3,4	Diode, Zener	IN5245	
CR5-16	Diode, Rect.	SD-6	Diodes, In
CR101,102	Diode, Zener	IN5245	
CR103,104	Diode, Rect.	SD-6	Diodes, In
F1,2	Picofuse	275002	Littlefus
HS1-4	Heatsink	106608	PEE
L1	Lamp	10CS	Sylvania
PTS.A-N	Connector	R93-12	Molex
Q1,3-6	Transistor	MM4003	Motorola
Q7-12	Transistor	MJE-340	Motorola
Q13,14	Transistor	2N2219	
Q15-30	Transistor	540121R	PEE
R1,2,3	Resistor 10K 1%	RN55C1002	
R4,6	Transistor 200K 1% 1/8W	RN55C2003	
R5	Transistor 100K 5% 1/4W Carbon		

250-H POWER AMPLIFIER BOARD

Ref. Desig.	Description	Part Number	Vendor
R6	Resistor 200K 1% 1/8W	RN55C2003	
R7,8	Resistor 33K 5% 2W		
R9	Resistor 68K 5% 1W Carbon		
R10	Resistor 1K 1/4W 5%		
R11	Resistor 33K 5% 2W		
R12	Resistor 2K 1/4W 5%		
R13	Resistor 390 1/4W 5%		
R14-19	Resistor 10K 1/2W		
R20	Resistor 270K 1/4W 5%		
R21,22	Resistor 100 1/4W 5%		
R23,24	Resistor 1K 1/4W 5%		
R25,26	Resistor 100 1/4W 5%		
R27	Resistor 22 1/4W 5%		
R28	Resistor 100 1/4W 5%		
R29	Resistor 390 1/4W 5%		
R31-36	Resistor 10K 1/2W		
R37	Resistor 270K 1/4@ 5%		
R38,39	Resistor 100 1/4@ 5%		

250-H POWER AMPLIFIER BOARD

Ref. Desig.	Description	Part Number	Vendor
R40,41	Resistor 1K 1/4W 5%		
R42,43	Resistor 100 1/4W 5%		
R44-47	Resistor 10 1/4W 5%		
R48-55	Resistor 2 2W BWH		
R56	Resistor .2 2W BWH		
R57	Resistor 2.7 1/4W 5%		
R58	Resistor 1K 1/4W 5%		
R59	Resistor 270 1/4W 5%		
R60	Resistor 1K 1/4W 5%		
R61	Resistor 270 1/4W Carbon		
R63,64	Pot 1K	3351W-1-102	Bourns
R65,68	Resistor 2 2W BWH		
R69	Resistor 10K 1/2W		
R70	Resistor 100K 5% 1/4W Carbon		
R71,72	Resistor 10K 1/2W		
R101-104	Resistor 33K 5% 2W		
R105-108	Resistor 100 1/4W 5%		
R109	Pot 10K	JAIL0405103VA	A-B
R110	Resistor 1K 1% 1/8W	RN55C1001	

250-H POWER AMPLIFIER BOARD

Ref. Desig.	Description	Part Number	Vendor
R111	Resistor 732 1/8W 1%	RN55C7320	
R112,113	Resistor 100K 1/8W 1%	RN55C1003	
R114	Resistor 5.11K 1/8W 1%	RN55C5111	
R115,116	Resistor 1/8W		
R117	Resistor 15M 5% 1/4W		
R165	Resistor 33K 5% 2W		
	Power Amp Board	106660	PEE
8 Pin Male	Connector	09-66-1081	Molex

92467